

**State Patrol Mobile Data Communications Network  
Final Report and Local Evaluation  
Phase III, Report 2**

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**By**

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## **Preface**

In completing this local evaluation, we reviewed the goals and documented how the goals were met or why they were not. This was done during the planning, procurement, and implementation process used in continuing the “Wisconsin State Patrol Mobile Data Communications Network Phase III” 1<sup>st</sup> allocation system infrastructure upgrade.

This report also presents a project overview, challenges and lessons learned for implementation of ITS support equipment and technologies for the “Wisconsin State Patrol Mobile Data Communications Network Phase III” 1<sup>st</sup> allocation data system.

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## Executive Summary

The Wisconsin Department of Transportation (WisDOT) has implemented a statewide digital microwave backbone infrastructure that is used to transport communications voice and data information for 161 public safety agencies throughout the State of Wisconsin. The information that is transported on the microwave system includes but is not limited to: routine daily voice communications, incident voice communications, driver license, license plate, criminal history, road sensor and Commercial Vehicle Information Systems and Networks (CVISN) information. Other low bandwidth roadway data that has or will be earmarked for transport by the statewide backbone infrastructure are included as well. The transported information is or will be available to Transportation Operating Centers (TOC), dispatch centers, public safety vehicles and emergency management centers.

The reason this funding was requested is that the WisDOT needed to expand and upgrade the statewide backbone infrastructure into in rural areas that presently do not have radio coverage. Public safety agencies in these areas cannot access the information that is available to agencies within the radio coverage areas. Most of the information that is transported on the backbone infrastructure is of a critical nature. Agencies not able to receive the information that is pertinent to their activity at any given time have a substantial safety risk. This risk does not only affect the agency itself but also affects the general public of which some portion is involved in most incidents either directly or indirectly. Part of the reason for the critical nature of the coverage in rural areas is that many times public safety personnel work alone. Their only help comes from the information that they can receive from the radio communications infrastructure they operate on. The statewide microwave backbone infrastructure allows them access to any information they need to efficiently and safely perform their duties.

The financial approach that WisDOT took was that the 50% match to the ITS grant would consist of funds taken the Wisconsin State Patrol, Bureau of Communications (BOC) base budget and the WisDOT capital budget encumbered for the needed tower sites.

The participating agencies were the Federal Highway Administration and the Wisconsin State Patrol. No other agencies had any involvement in the “Wisconsin State Patrol Mobile Data Communications Network Phase III” 1<sup>st</sup> allocation project. Although, dozens of agencies will reap the benefits of this project. The State Patrol operates and maintains the statewide microwave backbone infrastructure and will manage the integration of the components of this project into this infrastructure. The agencies that will operate off of the sites that are a part of the “Wisconsin State Patrol Mobile Data Communications Network Phase III” 1<sup>st</sup> allocation have full access to all available information. This project will be included in the whole as additional tower sites and microwave paths in the statewide microwave backbone infrastructure.

The funds for this project were used to purchase the necessary radio communications equipment needed to create a microwave path to towers in the areas not presently in radio

coverage. This includes power backup generators, equipment huts, tower strengthening accessories, VHF base and repeater stations, microwave terminals, interface cards, microwave dishes, waveguide, feedline, VHF antennas, alarms and security equipment. This equipment was installed at tower sites that include, Arland, Neillsville, Hayward, Arcadia, St. Croix Falls, Bloomington, Seneca and Mellen.

A structured procurement and implementation process was initiated with the following major tasks.

- Requirements assessment and statement of needs
- Procurement plan
- Deployment alternatives
- Specifications Development
- Procurement
- Implementation
- Test
- Training (if needed)
- Maintenance and Warranty

The Bureau of Communications (BOC) began this project in May of 2004 by assessing what the needs were at the various tower sites that support the mobile data system. This assessment was performed by the technical field supervisor in each of the three technical areas in the state. These supervisors found 12 sites out of the 69 sites we occupy required some substantial equipment or maintenance upgrades.

During the procurement planning process we separated out the type of equipment and services we would order with the federal funds from the tower site funds that we would use for the state match money. Several different bid specification documents had to be prepared.

In June of 2004, the procurement process was started to purchase the necessary equipment and crews to perform the tasks attached to the upgrade of this system. The first procurement was for tower crews because it was imperative that with winter getting set to move in we should get as much of the tower work done as possible in the early stages of the project.

During the time from June of 2004 to June of 2005 equipment and services were procured and construction and installs were completed. Testing was done as each segment was completed.

## Background

In the State of Wisconsin there always have been areas where the public safety agencies in the state could not have contact with another agency. With the increase in highway traffic over the years and the increase in crime that came with it, there was a serious need for better communications among these agencies. The State promoted scenarios that allowed public safety agencies in the state to install statewide emergency channels in their mobile radios, supported counties in efforts to have mutual aide base stations installed at various critical tower sites throughout the state and supplied state agencies with additional subscriber equipment for use in counties and municipalities where they operate on a different frequency band. There was some limited success with these programs.

In past years there were only voice radio communications systems in the state. Agencies were entrenched in their stand-alone conventional systems. Agencies just didn't want to give up their autonomy. As the state started planning for a pilot system test of mobile data technology we could see opportunity developing to have a statewide system backbone that any public safety agency in the state could access.

The first mobile data pilot materialized in the WisDOT in April of 1991. This pilot system was designed and implemented by the State Patrol, Bureau of Communications. It consisted of 2 mobile data terminals, 2 base stations located at strategic tower sites and an in-house router. The cost for this first pilot was very minimal. Mobile data proved to be a very useful technology. The next step was to implement a second pilot that included 70 mobile data terminals, 6 base stations located in high traffic areas and a vendor manufactured backbone. This implementation had a cost of approximately \$300,000.00.

In May of 1996 a Memorandum of Understanding (MOU) was executed between the Wisconsin Department of Administration (DOA) and WisDOT allowing WisDOT to install and operate the Mobile Data Communications System (MDCS) in the State of Wisconsin. The DOA provided initial funding of \$3,000,000.00 for system implementation. The implementation process was initiated at the end of May, 1996 and completed in October, 1996. Two antennas and a base station were installed at each of 48 tower sites that were either owned or leased by WisDOT.

In August, 1998 we converted the system from mobile data terminals to mobile data computers. At this time we changed the name of the data system to the Mobile Data Communications Network (MDCN). The detach and install program was implemented over a period of 2 years. As of today all users on the system have full computing technology in their vehicles. WisDOT had contracts in place for any subscriber equipment needed by the users. All public safety agencies can purchase off of these contracts. The WisDOT still operates, maintains and expands the system to accommodate users throughout the State of Wisconsin. Presently there are 161 Federal,

State, County Municipal, Tribal Nation, and Military agencies utilizing the system in all types of public safety activities. The system is routing crucial public safety information between 1453 in-vehicle computers and 3037 users. Each month of the last 4 years has seen a steady increase in the number of agencies requesting access to the system. To date, 100% of the funding for the backbone equipment and for subscriber equipment for the state agencies has come from the State of Wisconsin. This grant provided the funds the state used to purchase the backbone equipment that is installed at the tower sites.

Because the terrain in Wisconsin is less than desirable for wireless communications in some rural areas, the need for additional tower sites and equipment is becoming crucial. It is becoming increasingly more difficult to accommodate communities in rural areas where we do not have adequate coverage. The state has upgraded, replaced or added many tower sites it owns. There is also a continuous search for tower sites where we can lease space on the tower and in the associated equipment building. We have agreements in place with several tower owners that are willing to allow us use of their facilities. The more serious problem is that the state has no room in its biennial budget for the equipment needed to outfit these sites. As long as this situation persists, these rural public safety agencies and agencies asked to help them at an incident, in many cases, have poor interoperability. When there is an incident that requires substantial agency support the usual means of communication fail. Cell phones are the first to get tied up and then the normal operating channels on the public safety voice systems get convoluted with agencies walking on each other. The only thing that is normally still available is the MDCN. The public safety personnel on hand can message each other and their control center as well with pertinent information. The control centers can message all the mobile computers at the same time with no fear that someone didn't get the message. Of course this means that the vehicle must have a mobile computer and the incident cannot be in an area where there is no radio coverage. We know we can't control where an incident will be so we are making every attempt to assure seamless radio coverage where an incident might happen. The MDCN provides much more than these priority text messages. The opportunity to access driver information, vehicle information, criminal history, roadway data and CVISN will enhance the capabilities of public safety agencies and establish a safer working environment. Even though these efforts have proven themselves to be successful, the main issue remained. This issue is the fact that there are areas of the state where we still did not have any equipment and/or tower to supply the needed coverage.

Now that WisDOT has realized the importance of allowing public safety personnel access to useful information in their vehicles, the WisDOT has seen the need to expand the opportunities for them to receive even more data. This is why WisDOT has allowed the statewide voice and data backbone network to be used for transporting low bandwidth data from the road sensors and the CVISN program. In time, the availability of the backbone could be further expanded. The "State Patrol Mobile Data Communications Network" project for which this request was made will provide opportunity for agencies in rural areas to have access to this information as well.

## Evaluation Plan

### Teams:

We had three evaluation teams. The first team was for the northeastern area of the state and included a technician supervisor and three technicians. The second team was for the western area of the state and included a technician supervisor and three technicians. The third team was for the southern area and included a technician supervisor and four technicians. We had the three teams so we could get different perspectives on items like user satisfaction, implementation difficulties, vendor support and quality of operation.

### Strategy:

Our strategy was to set several goals. Some were recommended for this project by FHWA and others were goals that were important to us as the implementers and managers of the system and its components. The goals we set are as follows:

Safety, Mobility, Efficiency, Productivity, the environment, customer satisfaction, meeting timelines, quality, uniformity, and future expansion.

Safety – How will the upgrade of these tower sites provide a safer work environment for the officers using the network and a safer travel environment for the general public?

Mobility – How will we be able to provide increased mobility for the officers using the network?

Efficiency – Do these upgrades provide the level of efficiency that we anticipate?

Productivity – How will officer productivity be affected?

The environment – There is no environmental impact attached to the implementation of any of the components for this project.

Customer satisfaction – What is the customer response to the upgrades afforded us for this project?

Meet timeline – What are the issues that could affect our timeline and how do we work to keep them to a minimum?

Quality – How do we assure the quality of construction and service required of the vendors?

A. Measurable Quality of Operation – Are the generators load testing to the expected levels, are the base stations and microwave terminals operating flawlessly during daily routine operations as well as during a critical incident and are the air conditioners and heating units keeping the equipment huts at the proper seasonal temperatures?

B. Measurable Quality of Construction – Is the quality of construction of the equipment huts, concrete slabs for huts, towers, tower enhancements and fences acceptable.

C. Measurable Redundancy – Are the redundant microwave terminals, backup generators and transfer switches providing the switching needed for seamless operation?

D. Measurable Customer Satisfaction – Is the level of customer satisfaction where we feel it should be and, if needed, what can we do to improve it?

Uniformity – Is there a way to assure that the installation of the various equipment is uniform throughout the state?

Future Expansion – How does this project guarantee future expansion?

## **Project Overview**

The funding of the project was crucial to continued expansion of the MDCN to accommodate access by Federal, State, County, Municipal, Tribal Nation, and Military public safety agencies in rural areas, and to provide improved voice communications for these public safety agencies that may be operating in these poor coverage areas. The network that was in place, consisted of 69 tower sites connected together by digital microwave. The 3 main backbone legs are 1 DS3 and the stubs were anywhere from 1 T1 to 48 T1. At each tower site there was a 100 watt VHF base station and a 6 db gain antenna. Prior to this FHWA funding the State of Wisconsin had funded 100% of the MDCN backbone and all the subscriber units for state agencies on the system. Federal, County, Municipal, Tribal Nation, and Military public safety agencies are required to pay for their own subscriber equipment and will continue to in the future.

This expansion project was necessary to provide radio coverage in areas where the 69 sites presently in use do not. For the State of Wisconsin to have the type of coverage that is needed by public safety agencies operating in the state, it is imperative that the goal be for some limited hand-held two-way radio coverage. A preliminary engineering study demonstrated the need for a minimum of 60 additional tower sites to provide this kind of complete coverage. Approximately 20 more transmitter/receiver sites and 40 receiver only sites could accomplish our goal. The funding for this project has moved us closer to this goal.

Due to the uneven terrain in the State of Wisconsin it is impossible to get adequate coverage with the present number of sites. We are working diligently with Federal, State, County, Municipal, Tribal Nation, Military and the private sector to build or rebuild towers and buildings or lease space in buildings and towers owned by other agencies. On occasion we have been able to swap space they needed in our sites for space we needed in their sites. Once these sites were in place we had to purchase the backbone equipment needed for system operation. This equipment includes such items as tower sites (if none were available for lease in the area), tower site buildings or prefab huts (if none were available at the tower site chosen), base stations, antennas, coaxial cable, cavities,

microwave terminals, waveguide, dishes, emergency power generators, alarm equipment, interface cards and any other equipment or accessories needed to implement voice and data communications in the specified area. These sites and equipment were fully integrated into the present 69 site system that supports the voice and mobile data communications.

The FHWA funding for this project allowed us to outfit some of what we call “filler sites”. These sites are located in rural areas of the state and did not have reasonable mobile data or voice communications coverage. The filler sites were prioritized and the areas with the greatest need were picked for this project. These sites do not stand-alone because they are connected into the statewide voice and mobile data backbone network with access to all the available data and 161 user agencies on the system. Because the filler sites are connected to the network the doors of opportunity for other applications are opened as well. Because of this funding, dozens of small rural communities now have the opportunity to access the statewide voice and mobile data backbone network. The specific agency requesting access to the system must purchase and maintain their own subscriber equipment that includes the computer (and mount), appropriate interface and appropriate mobile radio.

**Requirements assessment and statement of needs:** An assessment of the conditions at each of our 69 tower sites was performed by the three evaluation teams. Each team assessed the conditions of tower sites in their technical region. They rated the condition of the tower itself, the condition of the equipment building, the need for equipment and the need for security upgrades. Special consideration was given to sites that were in areas where there was little or no mobile data or voice communications coverage. Through the evaluation and prioritization process 12 sites were picked to be a part of this project.

**Procurement plan:** The procurement plan was to purchase the two-way radio equipment with the State match money and to purchase the tower site upgrade items with the FHWA grant funds.

**Deployment alternatives:** We had a couple deployment scenarios. The first was to wait until all the site upgrades were completed and then install the two-way radios. The second was to start installing the radios while the upgrades were going on. The second scenario became the choice because we soon realized that most pieces of the total implementation were going to have interruptions. It made sense to simply implement whatever was available to try and keep the time line for completion to a minimum.

**Specifications Development:** The specifications development process went better than expected as most of the specifications for the various equipment and services we needed were already well documented. We did a little tweaking and they were ready for the bid process.

**Procurement:** The standard State of Wisconsin bid process was used. The bid specifications were sent out to the known vendors and posted on the State vendor net web page for any other vendors that were interested in bidding.

**Implementation:** This is where everything started to get exciting. The deployment scenario we chose definitely turned out to be the only approach that would work. We had numerous delays due to wrong equipment being shipped, equipment not meeting the specifications that were in the bid request, damaged huts not getting repaired in a timely manner, and tower crews not showing up due to other commitments or the weather. We started to withhold payments in order to get the vendors to focus on this project.

**Test:** All the equipment that could be or needed to be tested was put through a rigorous exercise to determine if they met specifications. The generators were load tested by the manufacturer at our site. The air conditioners were tested under the hottest weather conditions. The equipment huts were inspected for flaws. Two-way radio equipment was put through several tests to make sure it met FCC specifications and regulations.

**Training:** There was specialized training required for our technical staff on the base stations and the spread spectrum microwave. This was provided by the vendors as part of the purchase.

**Operations Planning:** This project only affected a small piece of the mobile data and voice radio backbone. There were no negative operational situations that we had to deal with because the tower sites are somewhat stand-alone entities.

**Maintenance and Warranty:** The equipment purchased with any of several contracts came with a 1 year parts and service warranty. When the warranty period expires the BOC staff technicians will perform any necessary maintenance, repairs and upgrades.

**Time Frame:** Due to the many problems discussed in the Lessons Learned section of this document this project was extended well beyond the original time frame. The Lessons Learned section of this document also provided us with information that will help us to maintain better control over the implementation process.

**This project involved the following tower sites:** Arland, Neillsville, Hayward, Arcadia, St. Croix Falls, Bloomington, Seneca and Mellen.

**Arland Tower:** The construction is completed on this tower site. All backbone equipment has been purchased and installed.

**Neillsville Tower:** The construction is completed. All backbone equipment has been purchased and installed.

**Arcadia Tower:** The construction is nearing completion on this tower site. All backbone equipment has been purchased.

**Seneca Tower:** The construction is nearing completion on this tower site. All backbone equipment has been purchased and installed.

Hayward Tower: The construction is completed. All backbone equipment has been purchased and installed.

Mellen Tower: The construction is completed. All backbone equipment has been purchased and installed.

St. Croix Falls Tower: The construction is completed. All backbone equipment has been purchased and installed.

Bloomington Tower: The construction is completed. All backbone equipment has been purchased and installed.

Ridgeville Tower: The construction is completed. All backbone equipment has been purchased and installed.

## **Conformance to National ITS Architecture:**

We developed an architecture for this project before we applied for the FHWA ITS grant (see ITS Architecture attachment). This architecture adheres to the requirements of the National ITS Architecture except in cases where the equipment was regulated by the FCC and the regulation is not a part of the National ITS Architecture at this time. Equipment huts are regulated by local zoning ordinances and specific land owners. The towers came under the regulation provided by Aeronautics and local zoning ordinances.

## **Project Evaluation:**

Our evaluation strategy set the following goals that we achieved.

**Safety:** This being the most important goal it received immediate attention. We did not wait for the sites to be complete before getting the communications radios in place. Where possible we installed the radio equipment immediately and did the site upgrades later. This gave the public safety users the coverage in some of these areas that had been required for a number of years. It also allowed the technicians to start testing this piece of the system and have it operating optimally within a short period of time. Now the users could operate in areas that they had no coverage in before. The users are far more comfortable with the system in these project areas than they were before. Contact and information sharing makes law enforcement activity in these areas much safer for the officer and the general public.

**Mobility:** This goal was attained from two different perspectives. First, the project provided an opportunity for the officers to move through several areas and never lose mobile data or voice coverage. Second, the project made handling incidents in the previously poor coverage area much simpler and allowed for quicker incident clean up and restored traffic flow.

**Efficiency:** It is obvious that the mobile data network is more efficient. The officers no longer have to wait until a dispatcher is free to run a request for data stored in the DOT and FBI data bases. If the mobile data system is busy the mobile unit automatically initiates 5 retries. Rarely, does the mobile unit get to the fifth retry.

**Productivity:** It has been noticed that an Officer that has a mobile data computer in his squad is generally twice as productive as he was before he got it.

**The environment:** There is no negative environmental impact associated with the implementation of any of the components purchased for this project. The only minor drawback to this project is it does require minimal AC power to energize the system.

**Customer Satisfaction:** Our customers are elated at the improvements to the mobile data and voice systems. They are pleasantly surprised that they can get this service from the State Patrol at no charge. They also appreciate the fact that improvements are made and any needed maintenance is taken care of very quickly.

**Meet Time Frame:** We had problems meeting our original time frame for completion of this project. The issues were many and are discussed in the “Lessons Learned” section of this document.

**Quality:** We monitored the vendors by having at least one member of our assessment team for that area at the site when vendors were there performing the contracted task. We also had an area supervisor available to the technicians as they performed a variety of tests to assure that installed radio equipment was operating optimally.

- A. **Measurable Quality of Operation:** The generators were tested for proper operation under the full load of equipment at the tower site. A pass or fail was documented and the vendor was required to repair the problem or replace the equipment. The AC power transfer switch was tested and the reaction time and reliability were documented. All issues were repaired by the vendor or the equipment was replaced. The microwave terminals were tested to make sure we were operating according to the FCC license that we hold. Our staff technicians made the necessary adjustments to bring us into compliance and optimal operation. The base stations were tested by our staff technicians for compliance and optimal operation and any repairs were provided by the vendors.
- B. **Measurable Quality of Construction:** The structural work done by the vendors was monitored by our staff to make sure we complied with local zoning and building codes. The points of attachment for the cross members that were added to some of the towers were checked for proper attachment. Clamps for the antenna and line that were attached to the tower were checked for proper torque. As the tower accessories were being mounted there was a technician on site to make sure that everything was accomplished in a BOC acceptable fashion. The equipment huts were inspected and approved for installation before they were set in place. The vendors had to make any changes and/or repairs prior to setting the

hut in place. The monitoring for this phase of the project was done by an area supervisor and his technicians.

- C. **Measurable Redundancy:** The data and voice communications network lack of down time indicates that the system is operating flawlessly from a user perspective. The users are not aware of the high level of redundancy the communications network has to assure little to no interruption to their service. Backup AC power, redundant microwave terminals, battery backup and remote monitoring assure that the system doesn't skip a beat.
- D. **Measurable Customer Satisfaction:** The MDCN has grown dramatically from just the State Patrol to an additional 161 public safety agencies and hundreds of users. This includes Federal, State, County, Municipal, Tribal Nation and Military public safety agencies. Any public safety discipline including law enforcement, fire and EMS can use the system if they choose to.

**Uniformity:** It is always in our best interest to have all the installations done at tower sites uniform. The technician supervisors and the technicians tend to have overlapping responsibilities. It is much more convenient, timely and cost effective to have all the installations accomplished in the same manner. We did a better job of accomplishing this than in the past.

**Future Expansion:** This implementation does not make a massive impact on future expansion but it does move us closer to seamless communications in some of the rural areas of the state. We still have a lot of work to do to completely blanket the state with mobile data and voice communications capabilities.

## **Collect/Analyze Data and Information**

**Equipment Specifications:** Documentation was made on each piece of equipment that was purchased for this project. It was found that in most cases the equipment arrived in an optimal state of operation with very little final adjustment needed. The units were thoroughly tested and the results were categorized and recorded for reference.

**Construction Codes:** As part of the bid specifications for services, it was mandated that the vendors had to meet with any applicable zoning committees in the tower site area to make sure that any and all permits were acquired and adhered to. All the vendors involved with this project secured the necessary permits for the work they would be doing.

**Customer Response to System Improvements:** Due to lack of capacity on the data and voice communications system we could not provide the kind of services that some of the public safety agencies in the state wanted. We have chosen to expand into areas that don't have coverage and allow as many agencies as possible to have at least some access to the information that is available in the mobile data environment. We are looking for some massive improvements to the backbone in the future but until the State of Wisconsin can erase its indebtedness there is not going to be a lot of money for these

types of very expensive projects. In the interim we are providing every agency in the state an opportunity to access the required text information that can make their job safer, easier, and faster than in the past. When the backbone becomes more robust we will offer the rest of the information they would like to have. Most of the public safety agencies in Wisconsin understand the situation and are supporting us in our efforts. Our user base has been growing and from the looks of recent mobile data equipment purchases will continue to grow in the future.

## **Project Challenges:**

**Standards:** We have structured our implementation to adhere to all the applicable ITS standards as shown in our architecture attachment. The microwave system transports the different data applications that agencies are using. We have no control over the applications that are carried on the microwave backbone. We simply provide an open architecture backbone that is compatible with the Internet Protocol (IP) at the data communications level and Ethernet protocol at the equipment level. (Ethernet protocol defines the wiring and signaling standards that enable different pieces of equipment to transmit data to and from each other.) Almost any modern application can be transported on the carrier. The base stations we use are expected to have an Ethernet port. Operation of the microwave and the base stations is regulated by the FCC and our licenses are current.

**Zoning:** Zoning issues are at a peak when it comes to tower sites. Because people do not understand the benefit they receive from having a public safety tower built or expanded in their area they oppose every move we make. The zoning committee meetings are usually attended by a number of dissenters that complicate things. Most of the time we prevail but it takes a considerable effort and is upsetting to our employees that have to be involved in the negotiations. Sometimes the general public wins (not really) and we have to look elsewhere for an inferior site to put a tower. Now two tower sites may be required to provide adequate communications interoperability.

**Shipping:** This issue was not serious but none the less created several delays because the vendors, in some cases, did not let us know that shipping costs were not included in their bid. When this happened we would have to go through the whole purchase process so the shipping charges would show up and we would add them to the total cost of the product when we purchased it. We also had a few zip code problems because one of our zip codes is for mail and the other for private delivery companies like FedEx. Some of our folks used the wrong zip code so equipment would not get delivered in a timely manner.

**Weather:** The timing for the release of the FHWA funds (August 15, 2003) did not allow us to get contracts in place for the outdoor work that needed to be done before the winter weather moved in. Tower and equipment hut work had to wait until the following spring (2004). The tower crews and other workers did get an early spring start and worked until the outdoor work was completed leaving the summer months of 2004 for most of the rest of the work.

## **Lessons Learned:**

There weren't any particularly new lessons to be learned on this project because most everything that was accomplished fell into the category of routine or daily operations. There was considerable reinforcement of lessons learned in the past that seemed to fall through the cracks over time.

We had several tower site implementations involved with this project. These projects involve the tower site landowners. They are always in a negotiation mode when changes to towers are on the agenda. The lesson we learned here is that we need to do a lot of the negotiating in advance of receiving expenditure authority for the grant funds.

Zoning ordinances and codes could have been investigated earlier in the project as well.

Probably the most important issue is the screening of vendors and distributors to try and avoid incidents with them that are either costly, time consuming or both. Low bid does not necessarily mean you must make an award to that vendor under any conditions. If there is documented proof that a vendor has not been fair, upfront or performed a poor quality of service you can eliminate that vendor from involvement in the bid process. The solution is to make sure that any improprieties are documented. We should have scrutinized vendors much more closely and documented any implementation issues.

The most interesting lesson learned is the fact that many buildings like the ones we have in the State Patrol have more than one zip code. There is a zip code for U.S. Mail and a different zip code for Fed Ex and UPS deliveries. This should be common knowledge but it gets forgotten on occasion and can hold up delivery to a particular building through out the state. Generally, it is only a day or two later but at times it could lead to problems. If it is something that we have to pick up and deliver the rest of the way it could lead to a second trip to the pick up point before we realize it is being held by the delivery company. We need to make more of our staff aware of this issue so it doesn't happen any more.